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HYHEAR 3 Roundup Ready® high erucic acid, low glucosinolate hybrid summer rape

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CULTIVAR DESCRIPTION

HYHEAR 3 Roundup Ready[®] high erucic acid, low glucosinolate hybrid summer rape

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R.W. Duncan, P.B.E. McVetty, J.L. Duguid, S.L. Fox, W. Paulmann, O. Sass, W.G. D. Fernando and G. Li. 2016. **HYHEAR 3 Roundup Ready[®] high erucic acid, low glucosinolate hybrid summer rape.** Can. J. Plant Sci. XX:xxx-xxx. HYHEAR 3 summer rape (*Brassica napus* L.) is a Roundup Ready[®] high erucic acid, low glucosinolate cultivar. On average, HYHEAR 3 yielded 15.6 % more seed, 4 g kg⁻¹ less seed oil and 22 g kg⁻¹ less meal protein than Red River 1861 Roundup Ready[®] high erucic acid, low glucosinolate summer rape. HYHEAR 3 has an erucic acid content of 50.9 % in isolated field trials of HEAR lines and is adapted to the southern *B. napus* growing regions of western Canada.

Key words: rape, hybrid Roundup Ready[®] high erucic acid, low glucosinolate, cultivar description

Tested as H118086 in the Western Canadian Co-operative Canola/Rapeseed High Erucic Acid Rapeseed (HEAR) Contract Registration Tests in 2013 and 2014, HYHEAR 3 is a Roundup Ready® summer rape (*Brassica napus* L.) hybrid cultivar having a high content of erucic acid in the seed oil (50.9%), and low content of glucosinolates in the seed meal (9.5 μmol total glucosinolates g^{-1} seed @ 8.5% H_2O). On average, HYHEAR 3 yielded 15.6 % more seed, 4 g kg^{-1} less seed oil and 22 g kg^{-1} less meal protein than the open-pollinated, Roundup Ready®, high erucic acid, low glucosinolate summer rape cultivar Red River 1861, the HEAR check designated by the Western Canadian Canola/Rapeseed Recommending Committee Inc. (WCC/RRC Inc.). HYHEAR 3 was collaboratively developed by DL Seeds/ Norddeutsche Pflanzenzucht (NPZ) Lembke and the Department of Plant Science, University of Manitoba, and it was issued a Certificate of Restricted Registration No. 8043 on June 3, 2016 by the Variety Registration Office, Plant Products Division of the Canadian Food Inspection Agency, Ottawa, Ontario. The terms of the restricted registration state that the registrant of HYHEAR 3 (i.e. Bunge Canada) shall implement and maintain a quality control system as reviewed and approved by the registrar. HYHEAR 3 is the third hybrid Roundup Ready® HEAR cultivar following HYHEAR 1 and HYHEAR 2 (McVetty et al., 2014; Duncan et al., 2016).

Pedigree and Breeding Methods

The HYHEAR 3 Roundup Ready® HEAR hybrid cultivar is developed based upon the DL Seeds/NPZ Lembke proprietary genetic male sterile Lembke (MSL) non-herbicide tolerant HEAR female line “MSL59900C NHT” and the University of Manitoba Roundup Ready® HEAR male line 10DH84. MSL59900C NHT was produced by crossing the HEAR sterile line MSL599A with the HEAR maintainer (fertile) line MSL600B. MSL599A was a BC_1F_4 selection from the cross PF 3356 C $\times$ Ho 3269-01 while MSL600B was a BC_1F_4 selection from the cross PF 3356 B $\times$ PF 2846-02. MSL59900C NHT was grown in

the field in 2007 and 2008 and selected for flowering time to verify flowering synchrony with 10DH84 and seed quality. 10DH84 with the pedigree 30609-B6 / Red River 1997 is a doubled haploid Roundup Ready[®] HEAR line. The initial cross was made in 2009 between 30609-B6 and Red River 1997, both carrying the gene for tolerance to glyphosate herbicide (transformation event RT73). Red River 1997 is a high erucic acid, low glucosinolate (*B. napus*) cultivar while 30609-B6 is a canola quality summer *B. napus* cultivar. The F₁ was grown in 2009 and microspores were subjected to a standard doubled haploid protocol. Seed from DH₀ plants was harvested in 2010 with selection was based on glyphosate tolerance and high erucic acid content. The DH₁ and DH₂ progeny were selected for phenotype, lodging resistance, oil, protein and glucosinolate content, and fatty acid composition including erucic acid content. The presence of the gene for glyphosate tolerance was monitored in every generation (for 10DH84) by spraying, and the purity of the transformation event RT73 was tested and confirmed in the Breeder/Certified Seed. Hybrid seed for H118086 was produced in isolation under tents in Chile 2012. H118086 was evaluated in advanced yield trials in 2012 for agronomic performance, seed quality and resistance to blackleg [*Leptosphaeria maculans* (Desm.) Ces. & de Not. (anamorph *Phoma lingam* (Tode ex Fr.)) Desm.] resistance and fusarium wilt [caused by *Fusarium oxysporum* f. sp. *conglutinans* (Wollenweb.) W. C. Snyder & H. N. Hans.] resistance. H118086 was advanced to the 2013 and 2014 HEAR Contract Registration Tests based on its superior agronomic performance, seed quality, blackleg and fusarium wilt resistance.

Performance

HYHEAR 3 was evaluated in 2013 and 2014 in the mid- and long-season zones of the WCC/RRC Inc. HEAR Contract Registration Tests. It surpassed Red River 1861 in yield in both zones and had an average yield advantage of 15.6 % (Table 1). HYHEAR 3 matured in 95 d, 1 day later than Red River 1861 and 1.5 days later than the mean of the WCC/RRC Inc. designated canola quality checks for maturity, 45H29 and

5440 (Table 1). HYHEAR 3 had a lower lodging score (1.9) compared to Red River 1861 (2.3) but higher than the mean lodging score of the WCC/RRC Inc. designated canola quality checks (1.7). HYHEAR 3 had an average seed oil content of 492 g kg⁻¹, 4 g kg⁻¹ lower than Red River 1861 and an average meal protein content of 468 g kg⁻¹, 22 g kg⁻¹ lower than Red River 1861. The erucic acid content of HYHEAR 3 seed averaged 50.9% of the total fatty acids in the seed oil, 0.9% lower than the erucic acid content of Red River 1861 seed produced in 14 high erucic acid rapeseed contract registration trials. The average total glucosinolate content of HYHEAR 3 whole seed on a 8.5% moisture basis, over the two years of official trials was 9.5 µmol g⁻¹ seed, higher than that for Red River 1861 (8.1 µmol g⁻¹ seed) but lower than the mean glucosinolate content of the WCC/RRC Inc. designated canola quality checks.

Other Characteristics

HYHEAR 3 was evaluated in disease resistance evaluations conducted in 2013, 2014 and 2015 by the WCC/RRC Inc. Based on the results from these tests, HYHEAR 3 was classified as resistant to blackleg disease and resistant to fusarium wilt (Table 1).

Maintenance and Distribution of Pedigreed Seed

Breeder seed of MSL59900C NHT and 10DH84 is maintained by DL Seeds, PO Box 2499, Morden Manitoba, R6M 1C2. HYHEAR 3 hybrid Certified Seed is produced by DL Seeds. HYHEAR 3 Certified Seed has at least 80% fertile F₁ hybrid seed and a maximum of 20% sterile plants that may include various percentages of the following: sterile F₁ plants, MSL59900C NHT plants, or sterile non-target F₁ plants. Certified Seed of HYHEAR 3 also has a minimum of 85% of the plants resistant to glyphosate herbicide.

Certified Seed of HYHEAR 3 is retailed by Crop Production Services (CPS), 210-407 Downey Road, Saskatoon SK, S7N 4L8 under contract to Bunge Canada, Bag #1, Highway 35 south, Nipawin SK S0E 1E0.

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Table 1. Seed yield, days to flowering, days to maturity, height, lodging, seed oil content, meal protein content, erucic acid content, total glucosinolate content and disease reactions of summer rape (*Brassica napus* L.) cultivars HYHEAR 3 (H118086), Red River 1861, 45H29 and 5440 in the Western Canadian Co-operative Canola/Rapeseed HEAR Contract Registration Tests in 2013-2014

Cultivar	Seed yield (kg ha ⁻¹)			Days to Flowering (d)	Days to Maturity (d)	Height (cm)	Lodging ^x (1-5)	Seed Oil ^w (g kg ⁻¹)	Meal Protein ^v (g kg ⁻¹)	Erucic acid ^u (%)	Total Gluco-sinolates ^t (μmol g ⁻¹ seed)	Blackleg Disease Severity ^s (0-5)	Fusarium Wilt Class ^r
	Long ^z Season Zone	Mid ^y Season Zone	Mean										
HYHEAR 3 (H118086)	2809	3319	3101	41	95	105	1.9	492	468	50.9	9.5	0.9	R
Red River 1861	2509	2810	2681	41	94	97	2.3	496	490	51.8	8.1	0.8	R
45H29	3341	3674	3532	41	93	109	2.0	486	449	-	13.6	-	R
5440	3274	3873	3616	42	94	111	1.4	470	447	-	12.5	-	R
LSD (0.05) ^q	170	174	123	0.7	0.5	7.6	0.2	3.4	4.4	0.8	0.6	-	-
Tests (2013+2014)	6	8	14	3	13	3	10	14	14	14	14	2	2

^zTests grown at Glenboro MB (2013-2014), Rosebank MB (2013), Warren MB (2014) and Winkler (2013-2014).
^yTests grown at Killam SK (2014), Lake Lenore SK (2013-2014), Rosthern SK (2014), Saint Albert SK (2013-2014) and Watrous SK (2013-2014).
^x1 = erect, 5 = prostrate.
^wOil content (whole-seed zero-moisture basis), by near infrared measurements.
^vProtein content (N x 6.25 in oil-free meal, zero-moisture basis), by near infrared measurements.
^uErucic acid (% of total fatty acids in seed oil), by gas chromatography, from seed grown in isolated fields of HEAR materials.
^tTotal glucosinolates (whole seed, 8.5% moisture basis), by near infrared measurements.
^sMean of two field tests grown in 2013 (Carman, MB) 2015 (Watrous SK), Westar mean 3.7 in these trials.
^rTests grown at Star City (2014) and Yorkton (2013).
^qLSD derived from cultivar-by-test interaction mean square.